

Attenuiconus marileeae, a new species of cone (Gastropoda: Conidae: Puncticulinae) from Curaçao

M.G. Harasewych

Department of Invertebrate Zoology
National Museum of Natural History
Smithsonian Institution
P.O. Box 37012
Washington, DC 20013-7012 USA
Harasewych@si.edu

ABSTRACT

Attenuiconus marileeae new species is described from deep reefs off southeastern Curaçao. It resembles *A. attenuatus*, *A. honkeri*, and *A. aureonimbosus* in size and general proportion of the shell, but is readily distinguished on the basis of its distinctive color pattern, which consists of a vivid orange-red base color with three bands of irregular, white flammules. *Attenuiconus marileeae* was collected at substantially greater depths than any of its Caribbean congeners. Only *A. aureonimbosus*, from the northeastern Gulf of Mexico, inhabits comparable depths. Like all species of *Attenuiconus*, nearly all specimens *A. marileeae* have one or more major repaired breaks indicative of unsuccessful attacks by crustaceans.

Additional Keywords: Deep Reef, Curasub, bottles, predation

INTRODUCTION

Over the past several years, sampling off southern Curaçao and adjacent islands using the manned submersible CURASUB as part of the Deep Reef Observation Project (DROP), a collaboration between the Smithsonian and Substation Curaçao, has greatly enriched our knowledge of the deep-reef faunas of the region and led to the discovery of range extensions and new species in multiple phyla.

Among the many mollusks collected is a new species of *Attenuiconus*, a genus of conids endemic to the tropical western Atlantic (Petuch, 2013; Tucker and Tenorio, 2013). Several specimens were among the hundreds of molluscan shells found in multiple glass bottles recovered from the ocean floor at depths ranging from 130–168 m. The age of the bottles ranged from mid-19th century to modern. Although nearly all these specimens were dead collected, they nevertheless provide insights into the molluscan biodiversity of the region, and include multiple range extensions and several new taxa. Many of the shells had at least one drill hole, and were likely brought into the bottles as food by small octopuses.

This new species is described and compared to *Attenuiconus attenuatus* (Reeve, 1844), the type species of *Attenuiconus*, a wide ranging species that occurs in southeastern Florida and throughout the Caribbean, including Curaçao, as well as to specimens of *Sandericonus sanderi* (Wils and Moolenbeek, 1979), the type species of *Sandericonus*, which was also present in the bottle samples.

SYSTEMATICS

Family Conidae Fleming, 1822

Subfamily Puncticulinae Tucker and Tenorio, 2009

Genus *Attenuiconus* Petuch, 2013

Attenuiconus Petuch, 2013: 212–213. Type species: *Conus attenuatus* Reeve, 1844, by original designation.

Diagnosis: “Shell small to average size for subfamily, very elongated, with straight sides and narrow, straight apertures; spires low or flattened, with projecting, mammillate protoconchs of 2 or 3 whorls; spire whorls may be flattened, or slightly canaliculated; shells generally smooth and polished, but some species have coarse sculpture of fine spiral threads; shells generally colored in yellows or oranges arranged in wide bands, but may be colored pink, salmon, reddish-orange with brown or white longitudinal flammules.” (Petuch, 2013: 212–213).

Remarks: In addition to the type species, which ranges from southern Florida throughout the Caribbean, Petuch (2013: 213) included within *Attenuiconus*: *A. eversoni* (Petuch, 1987) from Honduras, *A. honkeri* (Petuch, 1988) from Venezuela, *A. ignotus* (Cargile, 1998), from Honduras, Nicaragua and Colombia, as well as *A. poulosi* (Petuch, 1988) from Venezuela and Colombia. He noted that these species had previously been included in *Dauciconus* Cotton, 1945 by Tucker and Tenorio (2009), but that *Attenuiconus* may be distinguished from *Dauciconus* on the basis of its much

narrower and more elongate shell, and by its projecting protoconch. Tucker and Tenorio (2013) included *A. aureonimbosus* (Petuch, 1987), a species from the west coast of Florida, in *Attenuiconus*, but transferred *A. ignotus* to *Kellyconus* Petuch, 2013.

***Attenuiconus marileae* new species**
(Figures 12–18)

Description: Shell (Figures 12–16) of moderate size for genus (to 23 mm), with solid, narrow ($L/V \approx 2.1$), straight-sided, conical, low-conical spire, projecting protoconch, and narrow aperture. Protoconch (Figures 17–18) tall, conical, increasing in diameter from 291 μm to 850 μm in $3\frac{1}{4}$ evenly rounded, pitted glassy whorls. Protoconch forms a broad, smooth varix prior to transition to teleoconch (Figures 17, 18, arrows), marked by development of strongly tuberculate shoulder (17 tubercles on first teleoconch whorl, tubercles becoming weaker in subsequent whorls, absent by 5th whorl). Teleoconch with up to 8 sharply shouldered, straight-sided whorls. Suture adpressed in early whorls, may become shallowly impressed in later whorls. Sutural ramp narrow, weakly concave to flat, with 4–6 rounded cords between suture and shoulder. Last whorl smooth except for 5–6 broad, rounded spiral cords near anterior margin of shell. Aperture long, narrow ($L/V \approx 11$) with parallel sides, deflected from shell axis by $11\text{--}14^\circ$. Shell base color golden orange to orange red, with three bands of irregular white markings: one at and below the shoulder, one at mid-whorl, and one near the anterior margin of the shell. Band below shoulder broadest, consisting of very irregular, vaguely sigmoidal white flammules, which may be divided. White flammules extend over shoulder onto sutural ramp, but rarely reach suture. White blotches in relatively narrow band at mid-whorl range from small and compact (Figure 8) to large and amorphous (Figure 10), while flammules near anterior margin tend to form diffuse, oblique lines. Aperture color white. Radula, operculum, and periostracum unknown.

Type Material: Holotype, USNM 1195478. Paratypes 1–4, USNM 1240622, all from the type locality. Paratype 5, Petuch collection, also from the type locality.

Type Locality: Off the Sea Aquarium, Bapor Kibra, Willemstad, Curaçao, $12^\circ 04.48' \text{ N}$, $68^\circ 53.75' \text{ W}$, in glass bottles collected at 130–168 m, using the CURASUB submersible.

Distribution and Habitat: This new species is presently known only from off the southeastern coast of Curaçao, at depths of 130–168 m. Nearly all specimens have broken lips as well as one or more major repaired breaks, the latter indicative of prior, severe but unsuccessful attacks by crustaceans.

Etymology: This new species is named in honor of Marilee McNeilus in recognition of her longstanding interest in mollusks and her support of research. She participated in the submersible dives and assisted with

the specimen sorting that led to the discovery of this new species.

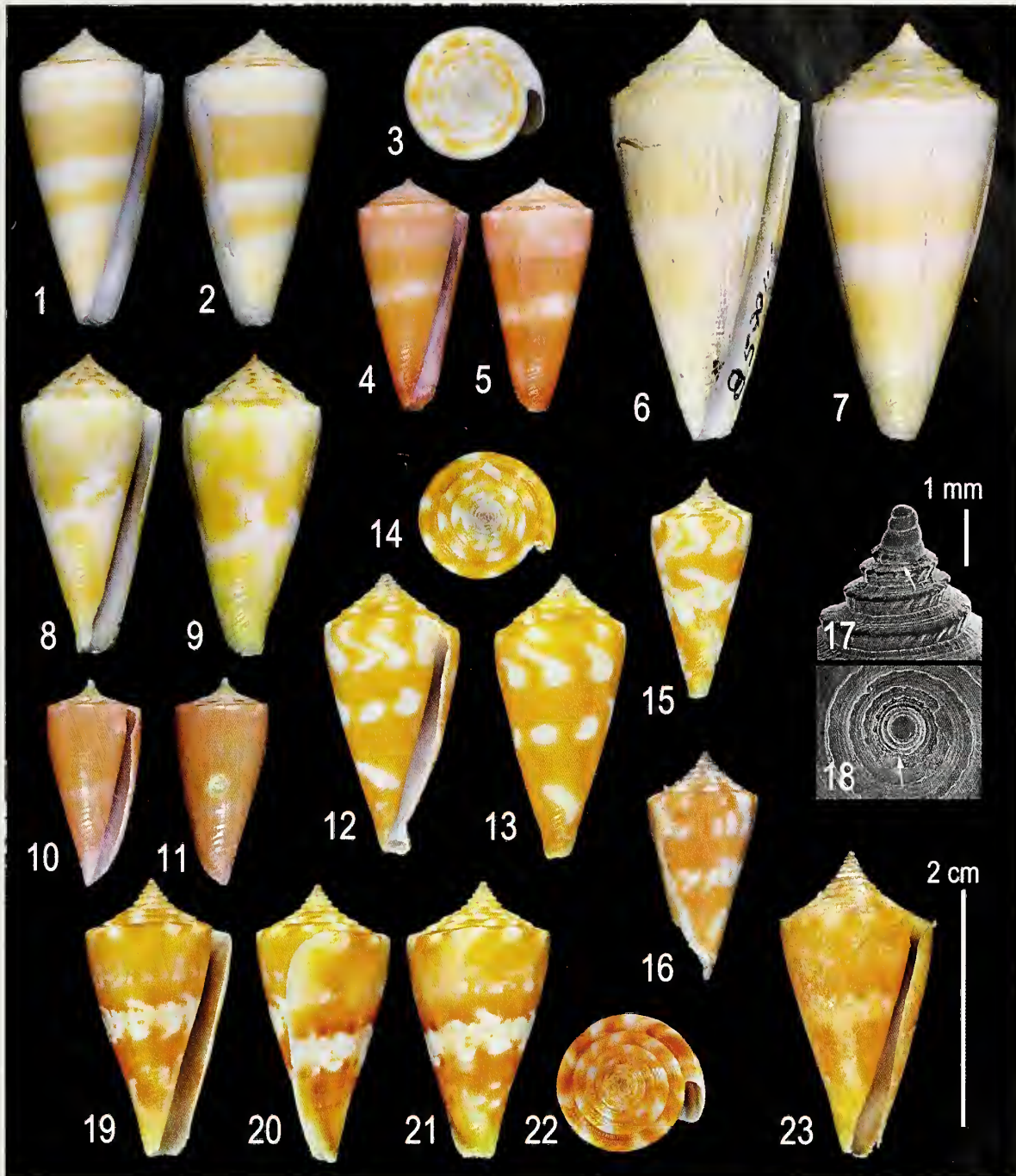
Comparative Remarks: *Attenuiconus marileae* resembles *A. attenuatus*, a wide-ranging species that occurs in southern Curaçao at shallower depths (Figures 1–3), in the size and proportions of the shell, but differs in having a more concave spire profile and more prominent spiral sculpture between the shoulder and suture. *Attenuiconus marileae* is most readily distinguished from all its congeners by its bright orange-red color and the large and distinctive patterns of white flammules that occur in three bands. The color patterns in *A. attenuatus* (Figures 1–5) and *A. honkeri* (Figures 6–7) usually take the form of fairly well-defined, parallel-sided bands of color. Both *A. eversoni* (Figures 10–11) and *A. poulosi* are easily distinguished from *A. marileae* by their flatter spires and more pointed early whorls, as well as by their more uniformly salmon-colored shells. *Attenuiconus aureonimbosus* (Figures 8–9) is similar to *A. marileae* in shell shape and proportion. It shares a similar pattern of irregular, nebulous white flammules, but is much paler in color. However, this species and *A. eversoni* tend to have a series of very fine spiral brown bands of spots, most evident between the shoulder and mid-whorl that are not present in *A. marileae*.

Attenuiconus marileae is easily separated from *Sandericonus sanderi*, a species of similar size and base color that also occurred among the specimens collected from the bottles. *Sandericonus sanderi* (Figures 14–18) has a broader shell with a flatter, more concave spire, a sharper shoulder, and a broad whitish band with nebulous margins at mid-whorl.

DISCUSSION

Conus, one of the original Linnean genera (Linnaeus, 1758), had, until recently, been considered to be the most species-rich modern marine genus, with more than 500 extant and several hundred extinct species (e.g., Röckel, Korn and Kohn, 1995; Duda, Kohn and Palumbi, 2001). Subsequent studies, which included information on radular morphology and molecular data, have partitioned the 743 cone species known at the time among three families, five subfamilies, and 114 living genera, an arrangement that is more in line with those of several other toxoglossan families (Tucker and Tenorio, 2013: 3). These authors note that the numbers are expected to increase, and the relationships among the taxa at all levels will continue to be refined as more data become available.

Within this new paradigm of conoidean systematics, *Attenuiconus* represents a small, poorly known genus limited to the western Atlantic, with greatest diversity in the southwestern Caribbean. The majority of species burrow in sandy bottoms at depths ranging from 10 to 50 m, although some of the SW Caribbean species and have been reported to live on sponge reefs (Petuch,



Figures 1–23. Species of *Attenuiconus* and *Sandericonus*. **1–5.** *Attenuiconus attenuatus* (Reeve, 1844), type species of *Attenuiconus* Petuch, 2013. **1.** Apertural, **2.** Dorsal, and **3.** Apical views of USNM 876325, off southeast shore of Curaçao, in 30–37 m, on sandy bottom. **4.** Apertural and **5.** Dorsal views of USNM 806476, off Dania, Florida, in 20 m, on sandy bottom. **6–7.** *Attenuiconus honkeri* (Petuch, 1988). **6.** Apertural, and **7.** Dorsal views of the holotype, USNM 859946, off the Los Monges Islands, Venezuela, in 35 m. **8–9.** *Attenuiconus aureonimbosus* (Petuch, 1987). **8.** Apertural, and **9.** Dorsal views of the holotype, USNM 859812, 50 km south of Apalachicola, FL, in 150 m. **10–11.** *Attenuiconus eversoni* (Petuch, 1987). **10.** Apertural and **11.** Dorsal views of the holotype, USNM 859878, off south coast of Utila Island, Bahia Islands, Honduras, among live *Agaricia* corals in 20 m. **12–18.** *Attenuiconus marileae* new species. **12.** Apertural, **13.** Dorsal and **14.** Apical views of the holotype, USNM 1195478. **15.** Dorsal view of Paratype 1. **16.** Dorsal view of Paratype 2. **17.** Lateral and **18.** Dorsal views of protoconch of Paratype 3. All type specimens from bottles collected in 130–168 m, using the CURASUB submersible, off the Sea Aquarium, Bapor Kibra, Willemstad, Curaçao. **19–23.** *Sandericonus sanderi* (Wils and Moolenbeek, 1979). **19.** Apertural, **20.** Lateral, **21.** Dorsal, and **22.** Apical views of USNM 1240614, Off Marie Pampoen, Willemstad, Curaçao, in 297 m, on sandy bottom. **23.** Apertural view of voucher specimen from the same locality that was the source of COI barcode sequence deposited in GenBank KJ751548. 2 cm scale bar applies to all shells, 1 mm scale bar applies to scanning electron micrographs of the protoconch. Arrows indicate transition from protoconch to teleoconch.

2013: 213). Only *A. aureonimbosus* from the northeastern Gulf of Mexico was reported from depths as great as 70–150 m. The depth at which *A. marileae* has been collected (130–168 m) is significantly greater than the bathymetric range for most *Attenuiconus*, but similar to that of *A. aureonimbosus*. As all available specimens of *A. marileae* were dead collected, it is possible that this species inhabits somewhat shallower waters, and that the shells may have rolled downslope and become occupied by hermit crabs prior to being brought into the bottles. However, other species of cones collected from the same bottles [(i.e., *Sandericonus sanderi* (Wils and Moolenbeek, 1979), *Conasprelloides villeginii* (P. Fischer and Bernardi, 1857), and *Dalliconus maei* (Deshayes, 1874)] are all known to inhabit the depths at which the bottles were collected (Rosenberg, 2009).

Living specimens of *Sandericonus sanderi* (Figures 19–23) were collected nearby, but at substantially greater depths (297 m).

ACKNOWLEDGMENTS

This research was conducted while participating in the Smithsonian Institution's Deep Reef Observation Project (DROP) operating at the Curaçao Seaquarium. Support from this program is gratefully acknowledged. Thanks also to Adriaan Schrier and the staff and crew of Substation Curaçao and the Seaquarium for their gracious hospitality and support. Special thanks to Marilee McNeilus and Cristina Castillo for assistance in the field and with sorting specimens, and to Yolanda Villacampa and Yesha Shrestha for their contributions in the laboratory. Drs. Edward J. Petuch and John Tucker provided helpful comments on drafts of this manuscript. This is Ocean Heritage Foundation/Curaçao Sea Aquarium/Substation Curaçao (OHF/CSA/SC) Contribution Number 5.

LITERATURE CITED

- Cargile, W.P. 1998. Description of *Conus ignotus*, a new species from Nicaragua. *Siratus* 2(14): 9–14.
- Deshayes, G.P. 1874. Description d'un cône nouveau des Antilles. *Journal de Conchyliologie* 22: 62–66.
- Duda, T.F. Jr., A.J. Kohn, and S.R. Palumbi, 2001. Origins of diverse feeding ecologies within *Conus*, a genus of venomous marine gastropods. *Biological Journal of the Linnean Society* 73: 391–409.
- Fischer, P. and A.C. Bernardi. 1857. Descriptions d'espèces nouvelles. *Journal de Conchyliologie* 5: 292–300, pl. 10.
- Linnaeus, C. 1758. *Systema Naturae per Regna tria Naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis ... Edicio decima reformata*. Impensis Direct. Laurentii Salvii. Holmae, Tom I. *Animalia*. [iv] + 823 pp.
- Petuch, E.J. 1987. New Caribbean molluscan faunas. Coastal Education and Research Foundation, Charlottesville, [v] + 154 + A1–A4, 29 pls.
- Petuch, E.J. 1988. Neogene history of tropical American mollusks. Coastal Education and Research Foundation, Charlottesville, [vi] + 217, 39 pls.
- Petuch, E.J. 2013. *Biogeography and Biodiversity of Western Atlantic Mollusks*. Boca Raton, Florida, CRC Press, xvii + 234 pp.
- Reeve, L. 1844. Monograph of the genus *Conus*. *Conchologica Iconica* 1:pls. 40–47.
- Röckel, D., W. Korn, and A.J. Kohn, 1995. *Manual of living Conidae*. Volume 1, Indo-Pacific Region. Christa Hemmen Verlag, Wiesbaden, 517 pp.
- Rosenberg, G. 2009. *Malacolog 4.1.1: A Database of Western Atlantic Marine Mollusca*. [WWW database (version 4.1.1)] URL <http://www.malacolog.org/>
- Tucker, J.K. and M.J. Tenorio, 2009. Systematic classification of Recent and fossil conoidean gastropods. Hackenheim, Conchbooks, 296 pp.
- Tucker, J. K. and M. J. Tenorio, 2013. *Illustrated Catalog of the Living Cone Shells*. Wellington, FL, MdM Publishing, iv + 517 pp.
- Wils, E. and R. G. Moolenbeek, 1979. Two new *Conus* species from off Barbados, Lesser Antilles (Gastropoda, Conidae). *Bijdragen tot de Dierkunde* 49(2):255–260.